

## SPECIFICATION

TO ALL WHOM IT MAY CONCERN

BE IT KNOWN that I, Richard C. Schaffer, currently residing in Texas, have invented new and useful improvements in a

TOILET WITH SELF-CONTAINED VENTILATION SYSTEM

of which the following is a specification:

# TOILET WITH SELF-CONTAINED VENTILATION SYSTEM

## SPECIFICATION

### Field of the Invention

The present invention relates to toilets and apparatuses for ventilating toilet bowls.

### Background of the Invention

Restrooms containing toilets are difficult to keep sanitary. This is true whether the restrooms are public or private.

When a human sits on a toilet, various gases may be emitted from the human. In addition, many now believe that the flushing of the toilet produces aerosols containing pathogens. These gases and aerosols permeate the restroom, contaminating surfaces, such as water valve handles at a sink, and objects, such as toothbrushes and towels, with germs.

I have developed a number of toilet ventilation systems, which systems exhaust the air from the toilet bowl out of the restroom. I have obtained the following U.S. patents 5,991,933; 5,875,496; 5,522,093 and 5,491,847. These systems ventilate the toilet bowl by drawing in the air from the bowl and out to a pipe in a wall of the restroom. These types of systems, while working quite well in ventilation, are expensive to install

because a vent pipe must be installed in the restroom wall, with the pipe either exiting the building through the roof or tying into another vent pipe.

### Summary of the Invention

It is an object of the present invention to provide a toilet ventilation system that is self contained.

It is another object of the present invention to provide a toilet ventilation system that is easy to install.

The present invention provides a toilet that comprises a bowl having a drain channel extending from the bowl. The bowl and the drain channel have a water trap. The bowl has an upper rim, which upper rim has an upper rim duct. The upper rim duct communicates with the bowl by openings. A water tank is located above the bowl. The tank has an aperture that is in fluid communication with the upper rim duct. The aperture in the water tank is covered by a base member in the water tank. The base member has a flapper valve that permits flushing of the bowl when opened. A vent pipe extends from the base member, and out of the water tank to a location of the drain channel that is downstream of the water trap. A fan is in line with the vent pipe. The vent pipe has a one-way valve therein to prohibit gases from downstream of the water trap from entering the bowl by way of the vent pipe. The portion of the vent pipe that is in the water tank has a float valve therein. The float valve is located at a predetermined height inside of the water tank. The float valve allows water to drain out of the water tank into the bowl.

In accordance with another aspect of the present invention, the vent pipe has an inside diameter of at least one inch.

In accordance with still another aspect of the present invention, a fitting is provided where the vent pipe enters the drain channel. The fitting allows the vent pipe to be removably coupled thereto.

In accordance with still another aspect of the present invention, the one-way valve is a flapper valve located on an end of the vent pipe in the drain channel.

In accordance with another aspect of the present invention, the vent pipe is at least partially positioned in-line with the water tank aperture. This provides for larger volumes of air to be exhausted from the bowl.

#### Brief Description of the Drawings

Fig. 1 is an isometric view of a toilet, equipped with the ventilation system of the present invention, in accordance with a preferred embodiment shown with the tank partially cut away.

Fig. 1A is a cross-sectional view of the connection of the vent pipe with the toilet.

Fig. 2 is a cross-sectional view of the toilet of Fig. 1.

Fig. 3 is a cross-sectional view of the vent pipe fitting in the toilet, shown with the vent pipe assembled onto the fitting.

Fig. 4 is a cross-sectional view of the vent pipe fitting in the toilet, shown with the vent pipe disassembled from the fitting.

Fig. 5 is a cross-sectional view, as seen from the bowl, of a prior art drain pipe in the tank.

Fig. 6 is a cross-sectional view, as seen from the bowl, of the vent pipe in the tank.

### Description of the Preferred Embodiment

Figs. 1 and 2 show a toilet 11 with a bottom portion 13 and a water tank 15. The toilet 11 is more fully described in my earlier U.S. patent number 5,991,933, the disclosure of which is incorporated herein by reference.

The bottom portion 13 has a bowl 17. The toilet bowl 17 has a water trap 19 at the bottom, which trap prevents odors from the drain pipe 21 from entering the bowl. Located above the water trap 19 is an air space. The bowl has an upper rim, within which is a duct 23 or conduit. The bottom of the upper rim duct 23 is perforated with apertures 25. The upper rim duct 23 communicates with an aperture 27 located rearwardly of the bowl 13. The aperture 27 receives water from the water tank 15. A drain channel 31 extends from the bottom of the bowl 17 up and over a lip 33 and then down to the bottom of the toilet. The water trap 19 is located in the drain channel and the bottom of the bowl 17. The drain channel 31 is aligned with the drain pipe 21 in the floor. In the preferred embodiment, water flows into the bowl 17 during flushing only from the apertures 25 at the upper rim. It is believed that the invention operates better without a flush opening at the bottom of the bowl.

The water tank 15 bears on a rear portion of the bottom portion 13. The tank 15 has an opening 35 in the bottom, which opening is aligned with the aperture 27 of the bottom portion 13.

Conventional water tanks have a flapper valve assembly located therein. The assembly is designed to completely cover the tank opening 35

(see Fig. 5). The assembly has a flapper valve 36 and an overflow tube 38, which tube extends up in the tank. The top of the overflow tube is located below the upper rim of the tank. When the water in the tank rises too high, it flows into the overflow pipe 38, through the aperture of the bottom portion 27 and into the bowl 17.

The present invention replaces the conventional flapper valve assembly with a modified flapper valve assembly 41, as shown in Figs. 1, 2 and 6. The modified assembly 41 has a base 43 that completely covers the tank opening 35. The flapper valve 45 is located on the base 43. A vent tube 47 extends up out of the base 43. The base 43 is unlike the base of the prior art flapper valve assembly of Fig. 5. The base 43 provides an enlarged vent pipe tube 47 and also repositions the vent tube 47 relative to the tank opening 35. The vent tube 47 is located partially over and in-line with the tank opening. In the preferred embodiment, the vent tube is located about halfway over the tank opening. This arrangement provides a larger and less obstructed passageway flow from the tank opening 35 into the vent tube, thereby providing for increased air flow.

The vent tube 47 exits the water tank 15. The vent tube exit in the water tank is sealed to prevent leakage. The vent tube is provided with a float valve 49. The float valve 49 is located at the maximum water level inside the tank. The valve 49 is normally closed; it opens when the water in the tank is at or near the maximum water level, and thereby allows the excess water to drain into the vent pipe and into the toilet bowl. With the float valve 49, the tank is prevented from overflowing. In the preferred embodiment, the float valve includes an opening in the upper portion of the

vent tube. The opening is covered with a flap of rubber or elastomer to provide a seal; the flap is on the outside of the tube and overlays the vent tube opening when the water level in the tank is low and the valve is closed. One side of the flap is connected to the vent tube; the other side can open to uncover the vent tube opening. The unconnected side is coupled to a float. When the water level in the tank rises, the float lifts the flap off of the vent tube opening and allows water to drain.

The vent pipe 47 exits the water tank. Instead of connecting to a pipe in the wall, the vent pipe is routed back to the side of the toilet, at a location that is below, or downstream, of the water trap 19. Figs. 1A, 3 and 4 show cross-sectional views of the entry area of the vent pipe into the toilet. The toilet has an entry port 51, which communicates with the drain channel 31 below, or downstream of, the water trap 19. The entry port has a fitting 53 that is permanently mounted therein with cement or some other adhesive. The fitting receives the end of the vent pipe 47.

In the preferred embodiment, the end of the vent pipe 47 has an end piece 61 and an intermediate piece 63. The end piece 61 is a rigid pipe and is inserted into the fitting 53. A stop surface inside of the fitting 53 or the toilet wall 13 is used to position the end piece. A flapper valve 57 is at the end of the end piece 61. When installed, the flapper valve is flush with the wall 13 so as not to impede flow through the drain channel. The flapper valve 57 has a hinge 59 that allows opening and closing. The flapper valve 57 has an inside rubber piece that seals the vent pipe when the valve is closed. A spring 65 maintains the valve 57 normally closed.

The intermediate piece 63 receives the vent pipe 47 in one end. The other end secures to the fitting 53 with conventional latches 67. A seal is provided between the pieces 61, 63. With this arrangement, the end piece 61 can be removed for cleaning.

The vent pipe 47 can be rigid or flexible. Alternatively, parts of the vent pipe can be rigid, such as inside the water tank, while other parts are flexible, such as those parts located outside of the water tank.

A fan 55 is located in line with the vent pipe 47. In the preferred embodiment, the fan is electric and is plugged into an electric wall outlet. Other types of fans can be used, such as battery powered fans. The fan is mounted to the side of the toilet, or underneath the tank, and is preferably off of the floor to allow for cleaning of the restroom. The fan is activated by a wall switch adjacent the toilet or by a connection to the same electrical power as the light switch of the restroom. Alternatively, the fan can be actuated automatically when weight is sensed on the toilet seat.

The vent pipe 47 should be of a sufficiently large diameter to draw large volumes of air out of the bowl. In the preferred embodiment, the vent pipe is 1 5/8 inches inside diameter PVC pipe. Many toilets have rim duct apertures 25 that are one-eighth inch in diameter. The ordinary toilet has small (1/8 inch) holes on the underside of the rim duct to allow flush water to encircle the bowl. The embodied toilet is of a special type in that all the flush water comes out the holes in the underside of the rim duct. This allows all the flush holes to be used for exhausting the toilet bowl prior to flushing.



The flapper valve is forced open by the exhaust pressure of the fan but closes water tight with the force of the flush and pull of the spring 65. The valve 57 is flush with the inner surface of the toilet was 13 so as to minimize obstruction of the drain channel and disruption of the siphon caused by flushing. The end of the vent pipe 47 can be removed from the drain channel for cleaning.

In operation, when the fan is turned on, air is withdrawn from the bowl 17, above the water trap 19, through the rim duct apertures 25, the rim ducts 23, bottom portion aperture 27 and the vent pipe 47. Because the vent pipe is enlarged and positioned in-line with the tank aperture 35 (see Fig. 6), larger volumes of air can be exhausted from the bowl. The vent pipe routes the air around the water trap 19 into the drain channel 31. The ventilation system removes air from the bowl and exhausts it to a location downstream of the water trap. Thus, the toilet and the ventilation system is self contained.

During and after flushing, the fan continues to operate so as to exhaust the aerosols caused by flushing from the bowl preventing them from entering the restroom. This is an important factor in preventing the spread of infection by aerosols. The fan can be pressure activated, or a timer can be provided so that once the weight is removed from the seat, the fan continues to operate for some predetermined period of time.

The foregoing disclosure and showings made in the drawings are merely illustrative of the principles of this invention and are not to be interpreted in a limiting sense.